AD NUMBER
AD473792
LIMITATION CHANGES
TO: **Approved for public release; distribution is unlimited.**
FROM: **Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 30 SEP 1965. Other requests shall be referred to Office of Naval Research, 875 North Randolph Street, Arlington, VA 22203-1995.**
AUTHORITY
ONR ltr, 4 May 1977

SECURITY MARKING

The classified or limited status of this report applies to each page, unless otherwise marked.
Separate page printouts MUST be marked accordingly.

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

(1)

(9) Quarterly Status Report No. 14, 1 Jul-30 Sep 65,

(6) NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM.

(16) ARPA Order [redacted] 306-20

Project Code Number 7300

Contract Number Nonr 3835(00)

(15)

(11) 30 Sep 65,

(12) 3p.

Office of Naval Research
Navy Department
Washington, D. C.

(10)

Author: Dr. Richard F. Woodcock.

Project Scientist: Dr. William R. Prindle

American Optical Company
Research Division
Southbridge, Massachusetts

During the three month period ending 30 September 1965, the investigation of the athermalization of laser glass has continued. The main areas of investigation were: (1) an independent method of measuring the thermal coefficient of refractive index, (2) determining regression coefficients for the stress-birefringence coefficient, and (3) the measurement of the stress-optical coefficient.

THERMAL COEFFICIENT OF REFRACTIVE INDEX

A system has been set up which provides an alternate method of measuring α_n to check on our present method of measurement. The alternate method employs a wave front shearing interferometer which measures the change in optical path thickness of a sample heated in a vacuum furnace by comparison with an identical unheated sample. The system has been assembled and is presently being tested. The light source is a mercury lamp which allows the determination of α_n for various wavelengths in the visible and near infrared.

STRESS-BIREFRINGENCE COEFFICIENT

A regression analysis of the stress-birefringence coefficient, ΔB, as a function of glass composition has been made resulting in a regression coefficient or weighting factor for each of the glass ingredients used. These results indicate some general trends in the effects of composition on stress-birefringence but the accuracy of many of the regression coefficients was too poor to draw any final conclusions at this time. In an effort to improve these values, $\Delta B'$s were calculated for the regression coefficients and compared with the measured values of ΔB. Glasses showing a marked discrepancy between calculated and measured values are being rechecked for possible error in the measured values.

STRESS-OPTICAL COEFFICIENT

Measurement of the stress-optical coefficients, $B_\perp$ and $B_\parallel$, have been made on additional glasses. The reproducibility of the measurement of the change in optical path length, $\Delta(nL)$, as a function of applied pressure has been improved. This, however, requires that a slight modification be made in the procedure for measuring ΔL. The above mentioned measurements of $B_\perp$ and $B_\parallel$ were made on glasses where the elastic constant was known and ΔL could be calculated from the applied pressure. To check these measurements the values of $B_\perp$ and $B_\parallel$ made in this manner were used to calculate

values of ΔB and the result showed reasonably good agreement with measured values of ΔB; e.g., for a glass with $B_{\parallel} = 7.2$ and $B_{\perp} = 9.7$ the calculated value of ΔB is -2.5 Brewsters compared to the measured ΔB value of -2.4 Brewster.

Some of our present experience indicates that the poor optical quality of our experimental glasses made in small, one pound melts may present a very serious problem in the measurement of the stress-optical coefficient by the present method. Further investigation of this situation is now in progress.